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3-5-07 Kandace Brown
(Date) Kandace Brown

IN THE UNITED STATES PATENT & TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicant(s):	Keegan et al.	)	Examiner: B. Lewis
Serial No.:	09/778,537	)	Art Unit: 1745
Filed:	February 7, 2001	)	
For:	SOLID OXIDE AUXILIARY POWER UNIT REFORMATE CONTROL	)	

APPEAL BRIEF UNDER 37 C.F.R. § 41.37

Mail Stop Appeal Brief – Patents

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This is an amended Appeal Brief filed in response to the Notification of Non-Compliant Appeal Brief mailed February 5, 2007 in the appeal from the final rejection of the Examiner dated April 18, 20064 rejecting claim 1-8, 10, 11, 13-15, 17-21 23-28, and 31-42. The Commissioner is hereby authorized to charge any fee associated with this amended Appeal Brief which may be due, or credit any overpayment, to Deposit Account No. 50-0831.

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I. REAL PARTY IN INTEREST

The subject application is owned by Delphi Technologies, Inc. of P.O. Box 5052, Troy, Michigan 48007-5052.

II. RELATED APPEALS AND INTERFERENCES

There are no known related appeals or interferences which would have any bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 1-8, 10, 11, 13-15, 17-21 23-28, and 31-42 have been rejected and are subject to this appeal;

Claims 43-56 have been withdrawn from this application; and

Claims 9, 16, and 22 are objected to as being dependent from a rejected base claim, but are otherwise allowable.

IV. STATUS OF AMENDMENTS

No amendment has been submitted after the final rejection.

V. SUMMARY OF CLAIMED SUBJECT MATTER

A fuel cell may be used to generate electric current by controllably combining elemental hydrogen and oxygen. *See Specification*, pg. 2, lines 8-12. Hydrogen fuel for the fuel cell may be supplied by a reformer that converts hydrocarbon fuel to a mixture of hydrogen and carbon monoxide known as

reformate. *See id.* at pg. 2, lines 13-15. Various methods have been used or proposed to control the flow of reformate from the reformer to the fuel cell, such as controlling the flow of hydrocarbon fuel into the reformer. Such schemes, however, often do not provide reformate fuel in a fashion so as to insure smooth operation of the fuel cell. The present invention provides such control by having a control valve 60 in the stream of reformate flowing from the reformer to the fuel cell (*see id.* at pg. 5, lines 22-23), and actuating the control valve in response to the pressure of the reformate stream, a desired reformate pressure, and the position of the control valve. *See id.* at page 6, lines 6-14.

More specifically, in independent claim 1, the present invention provides a method for controlling reformate delivered to an electrochemical cell in an electric power system. This method involves receiving a reformate pressure signal from a reformate pressure sensor (see *id.* at page 5, lines 20-22; *id.* at page 8, lines 17-19; and reference characters 22 and 104 in Figs. 2 and 4). The method also involves receiving a controllable valve position signal from a controllable valve disposed in the reformate (see *id.* at page 5, lines 24-27; *id.* at page 7, lines 1-3; *id.* at page 8, lines 22-24; *id.* at page 9, lines 26-28; and character references 40 in Fig. 1, 60 and 106 in Figs. 2 and 4, and 104 and 106 in Figs. 3 and 5). Then, claim 1 provides that the controllable valve is actuated in response to the reformate pressure signal, a desired reformate pressure, and the controllable valve position signal (see *id.* at page 6, line 5 – page 7, line 29; *id.* at page 8, line 28 – page 10, line 18; character references 104, 106, and 108 in Figs. 2 and 4, and Figs. 3 and 5 (all)).

In independent claim 23, the present invention provides a refromate pressure sensor disposed in the reformate and configured to measure reformate pressure at a reformer (see *id.* at page 5, lines 20-22; *id.* at page 8, lines 17-19; and reference characters 22 and 104 in Figs. 2 and 4). Claim 23 also provides for a controllable valve disposed in the reformate and configured to control the flow of reformate to the electrochemical cell responsive to a controllable valve command (see *id.* at page 5, lines 22-27; *id.* at page 7, lines 1-3; *id.* at page 8, lines 19-24; *id.* at page 9, lines 26-28; and character references 40 in Fig. 1 and 60 in Figs. 2 and 4). Claim 23 also provides a controller coupled to the reformate pressure sensor and the controllable valve, which receives a reformate pressure signal from the reformate pressure sensor and a controllable valve position signal from the controllable valve (see *id.* at page 5, lines 20-22 and 24-27; *id.* at page 8, lines 17-19 and 22-24; and character references 30, 104, and 106 in Figs. 2 and 4), and transmits a controllable valve command responsive to at least one of the reformate pressure signal, a desired reformate pressure signal, and the controllable valve position signal (see *id.* at page 6, line 5 – page 7, line 29; *id.* at page 8, line 28 – page 10, line 18; character references 104, 106, and 108 in Figs. 2 and 4, and Figs. 3 and 5 (all)).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1-8, 10, 11, 13-15, 17-21 23-28, and 31-42 stand rejected under 35 U.S.C. § 103(e) as unpatentable over Okada et al U.S. Patent 6,266,576 in view of Perry's Chemical Engineer's Handbook.

VII. ARGUMENT

Issue 1 – Whether independent claims 1 and 23 are patentable under 35 U.S.C. § 103(a) over Okada et al U.S. Patent 6,266,576 in view of Perry's Chemical Engineer's Handbook

Claims 1 and 23 are the only independent claims among the finally-rejected claims. The remaining dependent claims are each dependent on either claim 1 or claim 23, and claims 1 and 23 each distinguishes from the cited prior art on the same basis. Accordingly, for purposes of this appeal, these claims will be discussed as a group.

The Examiner takes the position that the Okada et al reference discloses each feature of Applicants' claimed invention except for the controller "receiving a controllable valve position signal", for which the Examiner relies on Perry's. Appellants point out, however, that claims 1 and 23 each also specifies that the control valve is disposed *in the reformate*, i.e., that it is downstream of the reformer. Okada et al's control valve 10 is located in the methanol supply line *to* the reformer, not in the reformate as required by Appellants' claims. Appellants also note that while Okada et al disclose a pressure regulator 11 disposed in the reformate, it appears to be a conventional regulator designed to maintain a *fixed* pressure, not a controllable target pressure as required by Appellants' claims.

The secondary Perry's reference is cited by the Examiner to show the technique of using the control valve position signal as an input to the control algorithm for controlling that valve. The Examiner has not pointed to any disclosure in Perry's that would lead one skilled in the art to put the control valve

in the reformate stream instead of the methanol feed stream as disclosed by Okada et al.

In response to Appellants' arguments regarding the Okada et al reference's failure to disclose a pressure control valve in the reformate stream, the Examiner asserted in the April 18, 2006 final rejection that the Okada et al reference discloses a shut-off valve 62 disposed in the reformate stream of Okada et al, which shut-off valve is "open and closed by a control signal from the fuel cell controller". However, neither the Okada et al nor the Perry's reference discloses controlling shut-off valve 62 in response to a desired reformate pressure and measured reformate pressure as required by Appellants' claims. To the contrary, the disclosure of Okada et al makes it clear that, as a shut-off valve, valve 62 operates in a binary fashion – either open (Okada et al col. 21, line 55 and col. 22, line 6) or closed (Okada et al col. 21, lines 55 and 64, and col. 22, line 22). Although Okada et al state at col. 21, lines 59-61 that the shut-off valve may be replaced with a proportional control valve, there is no disclosure or suggestion whatsoever of controlling valve 62 off of a desired reformate pressure and a measured reformate pressure signal as required by Appellants' claims. Instead, the reference discloses at col. 22, lines 1-38 that the fuel cell controller 56 opens and closes valve 62 in response to start and stop commands from robot operation control means 2. There is no disclosure or teaching whatsoever of controlling valve 62 in response to reformate pressure. Appellants submit that any suggestion that it would be obvious to modify Okada et al's control scheme to control the valve 62 in response to reformate pressure would

not even make sense, as valve 62 is positioned immediately downstream of pressure regulator 61, which maintains a fixed constant reformate pressure during operation (Okada et al col. 21, lines 53-54).

Clearly, neither the primary Okada et al reference nor the secondary Perry's reference discloses or suggests controlling a valve in a reformate stream being delivered to a fuel cell based on a desired reformate pressure and a reformate pressure signal (and a valve position signal, although this feature may be generally disclosed in Perry's). As such, Appellants respectfully submit that the Examiner's rejection is improper and should be reversed.

Respectfully submitted,

Dated: 3/5/07

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VIII. CLAIMS APPENDIX

The text of the claims involved in the appeal reads as follows:

Claim 1. (Currently amended) A method for controlling reformate delivered to an electrochemical cell in an electric power system, comprising:

receiving a reformate pressure signal from a reformate pressure sensor;

receiving a controllable valve position signal from a controllable valve disposed in said reformate;

actuating ~~a~~ said controllable valve in response to said reformate pressure signal, a desired reformate pressure, and said controllable valve position signal.

Claim 2. (Original) The method of Claim 1 wherein said actuating is responsive to a reformate pressure error signal responsive to the difference between said reformate pressure signal and said desired reformate pressure signal.

Claim 3. (Original) The method of Claim 2 wherein said actuating is in response to a desired controllable valve position value.

Claim 4. (Original) The method of Claim 3 wherein said desired controllable valve position value is responsive to said reformate pressure error signal.

Claim 5. (Original) The method of Claim 4 wherein said desired controllable valve position value is reduced if said reformate pressure error signal is

greater than a first pressure error threshold and increased if said reformate pressure error signal is less than a second pressure error threshold.

Claim 6. (Original) The method of Claim 1 wherein:

said actuating is responsive to a controllable valve position error; and

said controllable valve position error is responsive to the difference between a controllable valve position signal and a desired controllable valve position value.

Claim 7. (Original) The method of Claim 3 wherein said actuating is responsive to a controllable valve command.

Claim 8. (Original) The method of Claim 7 wherein said controllable valve command is responsive to a controllable valve position error.

Claim 9. (Original) The method of Claim 8 wherein said controllable valve command is reduced if said controllable valve position error signal is greater than a first position error threshold and increased if said controllable valve position error signal is less than a second position error threshold.

Claim 10. (Original) The method of Claim 1 wherein said actuating is responsive to a controllable valve command.

Claim 11. (Original) The method of Claim 10 wherein said controllable valve command is responsive to a controllable valve position error.

Claim 12. (Original) The method of Claim 11 wherein said controllable valve command is reduced if said controllable valve position error signal is greater than a first position error threshold and increased if said controllable valve position error signal is less than a second position error threshold.

Claim 13. (Original) The method of Claim 11 wherein said controllable valve position error is responsive to the difference between a controllable valve position signal and a desired controllable valve position value.

Claim 14. (Original) The method of Claim 13 wherein said desired controllable valve position value is responsive to a reformate pressure error signal.

Claim 15. (Original) The method of Claim 14 wherein said reformate pressure error signal is responsive to a difference between said reformate pressure signal and said desired reformate pressure signal.

Claim 16. (Original) The method of Claim 14 wherein said desired controllable valve position value is reduced if said reformate pressure error signal is greater than a first pressure error threshold and increased if said reformate pressure error signal is less than a second pressure error threshold.

Claim 17. (Original) The method of Claim 1 further including:

receiving a metered reformate pressure signal representative of the metered reformate pressure;

actuating said controllable valve in response to said reformate pressure signal, said metered reformate pressure signal, said desired reformate pressure signal, and said controllable valve position signal.

Claim 18. (Original) The method of Claim 17 wherein said actuating is responsive to an actual mass flow of said reformate, wherein an actual mass flow signal is computed from a pressure differential signal.

Claim 19. (Original) The method of Claim 18 wherein said pressure differential signal is responsive to a difference between said reformate pressure signal and said metered reformate pressure signal.

Claim 20. (Original) The method of Claim 18 wherein said pressure differential signal is utilized to index a look up table to yield said actual mass flow signal.

Claim 21. (Original) The method of Claim 20 wherein said actuating is responsive to a mass flow error signal responsive to the difference between a theoretical mass flow signal and said actual mass flow signal.

Claim 22. (Original) The method of Claim 21 wherein said actuating is responsive to a desired controllable valve position value which is reduced if said mass flow error signal is greater than a first mass flow error threshold and increased if said reformate pressure error signal is less than a second mass flow error threshold.

Claim 23. (Currently amended) A system for controlling reformate delivered to an electrochemical cell in an electric power system comprising:

a reformate pressure sensor disposed in said reformate and configured to measure reformate pressure at a reformer;

a controllable valve disposed in said reformate and configured to control the flow of reformate to said electrochemical cell responsive to a controllable valve command; and

a controller coupled to said reformate pressure sensor and said controllable valve, and

wherein said controller receives a reformate pressure signal from said reformate pressure sensor, a controllable valve position signal from said controllable valve, and transmits said controllable valve command responsive to at least one of said reformate pressure signal, a desired reformate pressure signal, and said controllable valve position signal.

Claim 24. (Original) The system of Claim 23 wherein said controllable valve command is responsive to a reformate pressure error signal responsive to the

difference between said reformate pressure signal and a desired reformate pressure signal representative of a desired reformate pressure.

Claim 25. (Original) The system of Claim 23 herein said controllable valve command is responsive to a desired controllable valve position value.

Claim 26. (Original) The system of Claim 25 wherein said desired controllable valve position value is responsive to a reformate pressure error signal.

Claim 27. (Original) The system of Claim 26 wherein said desired controllable valve position value is reduced if said reformate pressure error signal is greater than a first pressure error threshold and increased if said reformate pressure error signal is less than a second pressure error threshold.

Claim 28. (Original) The system of Claim 23 wherein

said controllable valve command is responsive to a controllable valve position error; and

said controllable valve position error is responsive to a difference between a measured controllable valve position signal and a desired controllable valve position value.

Claim 29. (Cancelled).

Claim 30. (Cancelled).

Claim 31. (Original) The system of Claim 23 wherein said controllable valve command is responsive to a controllable valve position error.

Claim 32. (Original) The system of Claim 31 wherein said controllable valve command is reduced if said controllable valve position error signal is greater than a first position error threshold and increased if said controllable valve position error signal is less than a second position error threshold.

Claim 33. (Original) The system of Claim 31 wherein said controllable valve position error is responsive to the difference between a controllable valve position signal and a desired controllable valve position value.

Claim 34. (Original) The system of Claim 33 wherein said desired controllable valve position value is responsive to a reformate pressure error signal.

Claim 35. (Original) The system of Claim 34 wherein said reformate pressure error signal is responsive to a difference between said reformate pressure signal and said desired reformate pressure signal.

Claim 36. (Original) The system of Claim 35 wherein said desired controllable valve position value is reduced if said reformate pressure error signal is

greater than a first pressure error threshold and increased if said reformate pressure error signal is less than a second pressure error threshold.

Claim 37. (Original) The system of Claim 23 further including:

a metered reformate pressure sensor coupled to said controller and configured to measure reformate pressure at said electrochemical cell;

wherein said controller further receives a metered reformate pressure signal generated by said metered reformate pressure sensor and said controllable valve command is also responsive to said metered reformate pressure signal.

Claim 38. (Original) The system of Claim 37 wherein said controllable valve command is responsive to an actual mass flow of said reformate, wherein an actual mass flow signal is computed from a pressure differential signal.

Claim 39. (Original) The system of Claim 38 wherein said pressure differential signal is responsive to a difference between said reformate pressure signal and said metered reformate pressure signal.

Claim 40. (Original) The system of Claim 38 wherein said pressure differential signal is utilized to index a look up table to yield said actual mass flow signal.

Claim 41. (Original) The system of Claim 37 wherein said actuating is responsive to a mass flow error signal responsive to the difference between a theoretical mass flow signal and said actual mass flow signal.

Claim 42. (Original) The system of Claim 41 wherein said actuating is responsive to a desired controllable valve position value which is reduced if said mass flow error signal is greater than a first mass flow error threshold and increased if said reformate pressure error signal is less than a second mass flow error threshold.

IX. EVIDENCE APPENDIX

There has been no additional evidence submitted, entered by the Examiner, or relied upon by the Appellant in the present appeal.

X. RELATED PROCEEDINGS APPENDIX

There have been no proceedings or decisions rendered by a court or the Board that relate to the present patent application.